Journal of the Society of Arts.

FRIDAY, SEPTEMBER 30, 1859.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

(*Continued from page* 696.)

Wednesday, September 21.—Some of the Sections met this day to complete the reading of such papers as had stood from the previous day. The following is the list of the papers read:

Section A.—Mathematical and Physical Science.

1. Professor Hennessy.—On the Figure of an Imperfectly Elastic Fluid.
2. J. P. Hennessy.—On the Inclination of the Planetary Orbits.
3. Professor Clerk Maxwell.—On an Instrument for exhibiting the Motions of a Ring of Satellites.
4. Professor Clerk Maxwell.—On the Dynamical Theory of Gases.
5. J. S. Stuart Glennie, M.A.—On a Proposal of a General Mechanical Theory of Physics.
6. J. J. Murphy.—On the Distribution of Heat over the Sun's surface.
7. Professor W. Thomson.—On the Reduction of Professor Forbes' observations of under-ground Temperatures.
8. Professor J. D. Everett.—On the same, with its application to Monthly Mean Temperatures.
9. Dr. Macvicar.—On the Philosophy of Physics.
10. M. l'Abbé Moigno.—On a New Photometer.
11. Professor Von Jacobi.—On the Comparison of Batteries.
12. Rev. T. Dale and Dr. Gladstone.—On the relation between Refractive Index and Volume.

Section B.—Chemical Science.

1. Professor Voelcker.—On Combinations of Earthy Phosphates with Alkalies.
2. Dr. Odling.—On Marsh's Test for Arsenic.
3. Messrs. Mulligan and Dowling.—Quantitative estimation of Tannin in some tanning materials.
4. Mr. C. J. Burnett showed some Specimens illustrating the use of Platinum in Photography.
5. M. Bialoblotzky.—On the Sedimentary Nature of Granite.

Section C.—Geology.

1. Sir David Brewster, F.R.S.—On a Horse-shoe Nail found in the Red Sandstone of Kingoodie.
2. Adolphe Radiguel, C.E.—On a Fragment of Pottery found in superficial deposits in Paris.
3. A. Gages.—Report on the results obtained by the Mechanico-Chemical examination of Rocks and Minerals.
4. C. G. Thost.—On the Rocks and Minerals in the property of the Marquis of Breadalbane.
5. A. Brady.—On the Elephant Remains at Ilford.
6. E. R. J. Knowles.—On some Curious Results in the Water supply, afforded by a spring at Ashey Down, in the Ryde Water-works.
7. Rev. J. Dingle.—On the Constitution of the Earth.
8. J. Price.—On Slickensides.
9. J. Beattie.—On a Cave near Montrose.
10. Rev. J. Morrison.—On the Remains of Lower Oolites in Urquhart, Elgin. Communicated by Dr. Longmuir.
11. W. S. Gibson.—On some Basaltic formations in Northumberland.
12. M. Bialoblotzky.—On the Sedimentary Nature of Granite.

The other Sections did not meet.

At three o'clock the General Meeting of the Association took place in the Music Hall, when the grants of money appropriated to scientific objects by the General Committee were announced. The following is the list, with the name of the member who, alone or as the first of a Committee, is entitled to draw for the money:—

	£	s.	d.
Kew Observatory.			
At the disposal of the Council for defraying expenses	500	0	0
Chemical Science.			
Sullivan, Professor (Solubility of Salts) ...	30	0	0
Voelcker, Professor (Constituents of Manures).	25	0	0
Gages, Mr. A. (Chemico-Mechanical Analysis of Rocks)	25	0	0
Smith, Dr. Angus (Scientific Evidence in Courts of Law)	10	0	0
Geology.			
Mallet, Robert (Earthquake Waves)... ...	25	0	0
Anderson, Rev. Dr. (Excavations in Yellow Sandstone of Dura-Den)	20	0	0
Murchison, Sir R. I. (Fossils in Upper Silurian Rocks, Lesmahago)	15	0	0
Zoology and Botany.			
MacAndrew, Robert (General Dredging) ...	50	0	0
Ogilvie, Dr. (Dredging North and East Coasts of Scotland)	25	0	0
Kinahan, Professor (Dredging in Dublin Bay).	15	0	0
Daubeny, Dr. (Growth of Plants)	10	0	0
Physiology.			
Allman, Prof. (Report on Hydroid Zoophytes).	10	0	0
Wilson, Dr. (Colour-Blindness)	10	0	0
Mechanical Science.			
Moorsom, Admiral (Steam-Vessels' Performance)	150	0	0
Thomson, Professor J. (Discharge of Water).	10	0	0
	£930	0	0

The business of the Association was wound up by unanimous and cordial votes of thanks to the Lord Provost and the Local Committee for their most successful labours in providing for the reception of the Association, and for the admirable arrangements made for conducting its business, as well as for the hospitality which the citizens of Aberdeen generally had shewn to the members of the Association. Thus ended the business of the Association, and one of the most successful meetings it has ever held.

On Thursday, the 22nd September, a party of about two hundred members of the Association left Aberdeen at six o'clock in the morning for Balmoral Castle, on the invitation of Her Majesty and the Prince Consort. They had a special train to Banchory, about eighteen miles, and posted the remainder of the journey, thirty-two miles, in carriages, previously arranged by the Local Committee to meet them at that place. The day was not very propitious, rain coming on previously to their arrival, showers and wind, with intervals of sunshine, succeeding each other during the whole of the afternoon. The party arrived at Balmoral shortly before two o'clock. Holiday was kept at the Castle. The Farquharson, Duff, and Forbes Highlanders marched in bodies to the grounds, and there were Highland games in part of the Palace. Her Majesty, the Prince Consort, the Prince of Wales, and other members of the Royal family, braved wind and weather, and watched the games with great interest, Her Majesty presenting the prizes with her own hand to the successful competitors. A déjeuner was served for the members of the Association in the ball room of the Castle, and at six o'clock the party started homeward, reaching Aberdeen about one o'clock in the morning.

During the visit a telegram arrived for Sir Roderick Murchison, announcing the arrival of the *Fox* with the

news of Captain M'Clintock's successful search for information setting at rest the fate of the long missing Franklin Expedition.

ON THE CONNEXION BETWEEN THE STRUCTURE AND PHYSICAL PROPERTIES OF WOOD.*

By Prof. Knoblauch.

Translated from the "Sitzungsberichte der Naturforschenden Gesellschaft." Halle, 1858, vol. v.

The author seeks to ascertain whether any connexion is ascertainable between the structural relations of various kinds of wood and their observed physical properties, such as their powers of resonance and conduction of heat, &c., in the same way as was done for one and the same wood by Savart in respect to resonance, and more especially by Tyndall in respect to the conduction of heat.

The primary object was to trace the difference in the conduction of heat shown by different woods, according as the heat has to traverse the wood in a direction parallel with, or at right angles to, the direction of the grain. For this purpose, slabs of the woods to be examined were bored through perpendicular to their planes, and then covered as uniformly as possible with a coating of stearine. A hot wire, exactly fitting the bore, was introduced into the latter and continually turned round during the experiment. By this means the coating of stearine around the orifice was melted; but, as we should expect, not in concentric circles, but in elliptic zones, whose major axes invariably coincided with the direction of the grain. The great difference in the behaviour of different kinds of wood (about eighty sorts were examined,) under these circumstances is at once apparent. With some the ellipses are tolerably circular, by others more elongated, while by others, again, the major axes are so extended as to be nearly twice the length of the minor ones. The eccentricity of these ellipses, which furnished a graphical expression for the conductive power of the wood in the directions between which the structural difference was greatest, made it possible to divide the different kinds of wood into four distinct groups. In the first, the ratio of the minor to the major axis of the ellipse is on the average as 1 to 1·25. To this group, acacia, box, cypress, king-wood, &c., belong. In the second, and by far the most numerous group, containing elder, nut, ebony, apple, several dye-woods, &c., the mean value of this ratio is 1 to 1·45. In the third group, to which apricot, siberian, acacia, Brazil wood, yellow wood from Puerto Cabello, &c., belong, the ratio is as 1 to 1·60. In the fourth group it is as 1 to 1·80, and to this division belong lime, tamarind, iron wood, poplar, savanilla (yellow), &c. Hence, the conducting power of all woods in the direction of the fibre exceeds that in the perpendicular direction by no means in a constant manner, but in one which depends upon the nature of the wood. This superiority is in the first group so small, that the warmth in the direction of the fibre traverses a path only a quarter more in length than that traversed in the same time in a perpendicular direction. In the last group, on the other hand, the length of the path in the first direction is about twice that in the perpendicular one.

In order to investigate the relations of resonance, two rods were cut from each kind of wood,—the one being taken in the direction of the grain (langholz), the second perpendicularly across it (hirnholz). On suspending these rods freely (their length was 470 millims., breadth 20 millims., and thickness 8 millims.) and striking them *with a stick*, the piece cut with the grain always gives a more sonorous tone than the corresponding cross-grain piece. Nevertheless, the difference of resonance in the tones of the with and cross-grain pieces of one and the same wood, of the first of the groups described (say beech), is unmistakably less than the difference between the tones of the with and cross-grain pieces of any member of the second group. In the second group this difference is less than in the third; and in the third, again, less than in the fourth (as with with- and cross-grain pieces of poplar). When, therefore, the fibres of all kinds of wood are set in vibration, the purity of resonance is greater when such vibrations are transverse than when they occur in other directions (as when the rods are cut across the grain). But this superiority of resonance is not constant; it depends upon the nature of the wood. The difference in this respect in the first group of woods is so small, that the resonance of two with- and cross-grain pieces resembles that of two not very dissimilar masses of stone when struck. In the last group the difference is so great, that the tone of the with-grain piece when struck has a metallic ring, while the dull sound of the cross-grain piece reminds one of a piece of pasteboard when struck. The division of the woods examined, derived from thermo-conductive power, is accordingly supported by their acoustic relations.

By supporting the two ends of the rods employed in the above experiments and loading them equally in the middle, the degrees of deflexion which they undergo will give us an insight into their structural relations; for the greater their compactness, the greater the resistance they will offer to bending; and the less compact they are, the more easily will they yield. The difference in vertical height of the middle points of the bent and straight rods was taken as measure of deflexion. A lever was employed to determine this measure, the end of which passed over an enlarged scale in order that the readings off might be the more exact. The unit of this measure was a matter of indifference, inasmuch as in the comparison to be instituted, relations only had to be determined. Although, as was to be expected, in all cases the with-grain piece was much less flexible than the corresponding cross-grain piece, yet an important difference was noticeable in the different groups. This is best seen by calculating the relation between the bending (measured as above described,) of the with-grain and that of the cross-grain wood; that is, the same weight being applied (say 100 grs.), by dividing the number given by the lever with the cross-grain piece by that given with the with-grain piece. This relation (called "ratio of deflexion" in the following table) has, in the first group, the mean value of 1 to 5; in the second, 1 to 8; in the third, 1 to 9·5; in the fourth, 1 to 14. The division of the groups is therefore also supported from this point of view.* The difference in the structure in the different directions is least in those woods which show the least difference with respect to direction in their thermo-conductive and resonant properties; and the difference in the former is greater or less as the two latter differences are greater or less.

Hence, a definite relation may be established between the different phenomena described; and this is true to such an extent, that the knowledge of one of them, *e.g.*, the mechanical or state of cohesion is sufficient to deduce the others, those of warmth or resonance.

Thus, merely to adduce one example, especial experiments had shown that in petrified woods a difference of structure in the directions parallel with, and perpendicular to, the direction of the grain had been preserved, and, in fact, the thermal curve was an ellipse whose major axis was parallel to the fibres. As in the petrified example, this difference in mechanical structure was much less than in the living wood, so, also, while in the living Conifer the ratio of the axes was as 1 to 1·80, in the petrified specimen it had sunk to 1 to 1·12.

* From the Lond., Edin., and Dub. Mag., May, 1859.

* The diversity of nature, even with one and the same kind of wood, of course did not admit of the boundaries of the groups being drawn with great exactness, or of the subdivision of the groups into secondary ones.

The following table contains the names of the woods examined, arranged according to the groups mentioned:—

Group I.

Ratio of the axes of the thermal ellipse 1 to 1·25. Mean ratio of deflexion 1 to 5·0.

Acacia.	King wood.
Box.	Satin wood.
Lignum-vitæ.	Salisburia (*Gingko*).
Cypress.	

Group II.

Ratio of axes of thermal ellipse 1 to 1·45. Mean ratio of deflexion 1 to 8·0.

Elder.	Snake wood.
Alder.	Zebra wood.
White Thorn.	Purple wood (*Amaranthus*).
Arbor vitæ.	Settin.
St. Lucian wood.	Coromandel wood.
Gymnocladus canadensis.	Angica wood.
Beech (2 species, white and red).	Cocoa wood (*Gateado*).
Plane.	Apple.
Elm.	Pear.
Oak (two species).	Cherry.
Ash.	Plum.
Maple.	Sandal (red).
American maple.	Caliatour.
Cedar of Lebanon.	Costarica (red wood).
Australian cedar.	Bimas sapan.
Mahogany.	Cuba (yellow wood).
Palisander.	Viset (yellow wood).
Ebony.	Campeachy blue wood.
Palm.	Tobasco blue wood.
Rosewood.	Domingo blue wood.

Group III.

Ratio of axes of thermal ellipse 1 to 1·50. Mean ratio of deflexion 1 to 9·5.

Apricot.	Pernambuco red wood.
Pistachio.	Japan red wood.
Siberian Acacia.	Puerto-Cabello yellow wood

Group IV.

Ratio of the axes of the thermal ellipse 1 to 1·8. Mean ratio of deflexion 1 to 14·0.

Willow (two examples).	Weymouth fir.
Chesnut (three examples).	Magnolia.
Lime.	Iron wood.
Alder.	Tamarind.
Birch.	Palmassu.
Poplar (three examples).	"Kistenholz."
Aspen.	Caoba (Havanna Cedar).
Pine.	Savanilla yellow wood.
Fir.	

BOTANIC GARDENS AT KEW.

A report on the progress and condition of these gardens from the commencement of 1853 to that of 1859 has been addressed by Sir W. J. Hooker, the Director, to the First Commissioner of H. M. Works.

In the introduction to this report the Director says that its object is to afford a more detailed account of the Royal Gardens, Museums, Herbarium, and Library at Kew, and of the scientific and other services rendered by them to the public, than can be contained in the brief accounts which accompany the annual estimates. It relates chiefly to the last six years; a period which the Director has selected, mainly because, until 1853, this establishment altogether lacked two of the most essential requisites of a National Botanic Garden, namely, a herbarium and a library;* by which only can the objects in the garden and museum be properly named, arranged, and ticketed, and that information be afforded to manufacturers, travellers, and men engaged in the arts, sciences, or horticulture, which is there daily sought.

It is also since 1853 that the new museum has been built and its contents arranged; that a magnificent collection of vegetable products has been acquired from the French Exhibition; that the demand for more ornamental plants in the gardens and conservatories, and for the use of the schools of design, has been as much as possible supplied; that the gardens and museums have been thrown open to the public on Sunday afternoons; that the average of visitors has risen to upwards of 1,000 daily; and that the requests for information, the correspondence on vegetable products, and the number of donors to the establishment have all augmented more than two-fold.

Within this period, too, the most complete aboretum in Europe has been formed in the pleasure-grounds, nurseries have been established for stocking with trees the Metropolitan parks (and these are already found very profitable); the Queen's Garden has been enlarged by 14 acres; and a lake 4½ acres has been commenced in the pleasure-grounds, and an enormous quantity of earth removed from it, at no cost to the public.

As regards the staff, since 1853 an assistant has been appointed to the director, and one to the curator; constables (Crimean soldiers) have been selected to keep order during public hours; the foremen have been put on a better scale of remuneration; while more liberal pay and promotion to the gardeners have greatly increased their efficiency, by rewarding the meritorious, and encouraging the deserving men; and an allowance for medical attendance and support has also been granted, both to gardeners and labourers when sick.

Owing to the unparalleled advantages afforded by these vast collections to scientific men, a large number of works in the English, Latin, French, and German languages have been executed more or less at Kew, by distinguished British and Foreign naturalists, upon Economic and Scientific Botany. An increase has also taken place in the number of young men instructed there, and sent out as naturalists or collectors to Government expeditions and commercial enterprises, or as curators of scientific gardens in England, the Colonies, and on the Continent.

The Director goes on to say:—"Thus it is only within these six years that the Royal Gardens can be considered as becoming a nearly complete national establishment. Till 1853 they were but in course of formation; whereas they now approach that condition when any considerable extension would, in the state of our present commercial and scientific relations, be unadvisable; and when (the long-desired conservatory once completed) we shall do better to economise our means than indefinitely to enlarge them. It must not be forgotten that, 18 years ago, England stood alone in having no national botanic establishment like Paris, Berlin, Vienna, Gottingen, Petersburg, Copenhagen, and even Stockholm; and that within this period we have been called upon to rival foreign gardens, some of which had enjoyed for more than two centuries the lavish patronage of their respective governments; added to which, that (thanks chiefly to the Horticultural Society) the gardens of the universities and of noblemen and private individuals, and of many provincial towns in the kingdom, had attained an excellence during that time which it would have been discreditable to the Royal Gardens not to rival."

After giving an account of the organisation of the staff, the report proceeds to describe the gradual development of the present establishment:—

"On the transference, in 1841, of the botanic gardens, by the Royal Family to the public, they consisted only

* Till that time these desiderata were wholly supplied by the Director's private herbarium and library.

of 11 acres, and were extended by successive additions till, in 1847, they had reached their present dimensions of 75 acres; this is exclusive of the pleasure grounds. As regards the number of visitors, beginning with 9,174 in 1841, the increase has been gradual to 405,376 in 1858 (exclusive of those to the herbarium and library); while the generally good behaviour of this mass of people, often inconveniently crowding the plant-houses and museums, the eagerness with which they inspect the more curious and interesting plants and their products, and read the notices and explanations given in the guide books and attached to the objects in the museum, all evince that such privileges minister food to the mind as well as health to the body.

"The greatest number of persons admitted in one day to the gardens (where they have free access to all parts,) has been 13,761. The best attended months, as may be supposed, are June, July, and August, during which we have numbered so many as 267,223 persons. The fewest visitors are in November, December, and February, when they have been so low as 4,679.

"For the further gratification of the public, the Commissioners have, during the last three years, obtained an increased grant for the higher keep and ornament of the gardens.

"The hours of admission to the Royal Gardens are from 1 p.m. till dusk, on week days, and from 2 p.m. on Sundays. On Christmas day only they are wholly closed.

"Incessantly are applications, personal and written, made for leave to visit the gardens before 1 p.m.; but they are necessarily refused, except to persons who have actual business or other claims to be admitted. Considering that, as previously explained, the whole of the work in the houses and museums must be concluded before noon (the dinner hour for the men), it is obvious that the exclusion of the general public till 1 p.m. must be rigidly enforced; otherwise the foremen cannot be answerable for the safety of their respective collections, or the steady working of their gardeners, who are often addressed, and are in many ways interrupted in their duties, by strangers.

"Connected with the garden establishment is a very important feature—the Gardeners' Library and Reading Room. It consists of two small apartments, adjoining the Director's office, and contains a selection of the more useful works on Horticulture, Elementary Botany, Geography, and Physics, Agricultural Chemistry, Landscape Gardening, and a few volumes of Voyages and Travels, together with two horticultural weekly journals, some maps, and a small supply of stationery for the use of readers. It is open every evening for the gardeners, under the direction of the curator and foremen.

"The pleasure grounds consist of 250 acres, separated by a wire fence from the botanic gardens, and opening into them by four gates. They were placed under my charge in 1846, since which time they have been laid out primarily as an arboretum, for the cultivation of every tree and shrub which will stand the open air in this climate."

Among the more remarkable features of the pleasure grounds are mentioned the arboretum, the nurseries, the lake (which is in process of formation) and the Queen's Garden.

"There will further be the great conservatory (if sanctioned by Parliament), and the flag staff, of Douglas pine," (Abies Douglasii) from British Columbia, a magnificent spar, 118 feet long, which has been presented to the gardens during the preparation of this report, and which it is proposed to erect on a hill in these grounds.

"The peculiarities of the climate of England render it singularly favourable for the growth of a large collection of the trees and shrubs of temperate regions, from almost all parts of the globe; and hence arose the eminent desirableness of attaching to the Royal Gardens such an arboretum as should be worthy of Great Britain, and serviceable to its extensive possessions and foreign relations.

"In pursuance of this object, the best suited localities in these grounds have been devoted to a classified collection of hardy trees and shrubs, amounting to about 3,500 kinds (including marked varieties), and they are mostly in a thriving condition.

"There are two nurseries in the arboretum; one specially intended for planting the Kew Grounds with ornamental trees and shrubs, and rearing a stock for exchange; the other (formed at the desire of the First Commissioner in 1855), to supply the Metropolitan parks. Both are profitable; and the latter has proved to be a very useful part of this establishment."

With reference to the museums of economic botany, the Director says:—

"The formation of this establishment suggested itself to my mind in 1857, when a very humble building (within the precincts of what had been the kitchen and fruit garden), which had been used for the conservation of the fruit for the Royal table, was no longer required for that purpose. It promised to afford, for a time, the needful accommodation for a display of the various products of the vegetable kingdom; especially such as are in demand by the merchant and manufacturer, the timber-dealer, the cabinet-maker, the druggist, &c., and to form, in short, the nucleus of a museum of economic as well as structural botany, which should contain all that was interesting or curious in vegetable organisation, and that could not be preserved nor generally exhibited in the living state. Such a collection could not fail to answer the *cui bono?* so often propounded, by showing the uses and applications of plants. It was commenced by the transference to this building of considerable series of articles of this nature, which the Director had been forming during the previous 40 years, in connection with his own private herbarium; and, thanks to the contributions of friends, in a few years' time the ten apartments (two of them of considerable dimensions) in this museum were full. An additional structure, of much more capacious accommodation, was then required; it was commenced in 1855, finished early in the summer of 1856, and but little vacant space is to be seen in 1858.

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"The cost incurred by increasing the contents of the museum has been exceedingly small; for owing to the interest felt in these collections, it is seldom necessary to buy specimens; they are almost invariably given, and in the case of articles imported into England, often without being asked for. The majority are, however, procured by correspondence direct from the countries producing them.

"Demands for duplicate specimens from the museums are frequently and most energetically urged; and they mostly emanate from public establishments, and especially provincial museums. But I need hardly remark that the preparation, conservation, and naming of museum articles are works of much time, labour, and skill. In most instances the specimens are preserved in glass, often in fluids, and to be of service as museum objects they must be ample and prominent. Thus the value of the specimens is trifling to that of the time consumed in packing, unpacking, selecting, correctly naming, and fitting them for public inspection. To carry out in the museum the complicated system of exchange and distribution pursued in the garden and herbarium, it would be necessary not only to increase the assistants and the present accommodation for duplicates, but to provide a special scientific curator, who should be answerable for the accuracy of the names and proper selection of the specimens sent out, and for such a distribution as should satisfy claimants of all degrees. For it is obvious that errors of information, emanating from Kew, or jealousies excited by apparent partiality to one recipient above another, are not only directly prejudicial to the establishment, but a reflection on it. Duplicates do indeed occasionally accumulate; but much less than is supposed, both because we decline accepting them, and because many

articles spoil by keeping, and require renewal. Such duplicates are given away from time to time to individuals who have most benefited the museum and gardens; or they are sent to the colonies, where similar museums are being formed. In conclusion, I would remark that the Kew Museums were established to indicate how such institutions may be founded and conducted, and not as the source whence they are to draw.

"To render the Kew Gardens a complete botanical establishment, a herbarium and library were long a desideratum. True, the very extensive library and herbarium belonging to me were accommodated in a suitable building, the property of the crown; and by an arrangement between the Board of Works and myself, they were thrown open, with the needful attendants, to all men of science. And in 1855, as fully recorded in former reports, two collections of dried plants (Herbaria) were added as gifts, and they now form that portion of this department which belongs to the crown. These, combined with my own, unquestionably constitute the most extensive and practically useful herbarium and library ever formed; and they cannot fail to be, and have indeed already proved, of inestimable service to all who are engaged in subjects connected with botany and horticulture."

In proof of this assertion the Director subjoins a list of the thirty-six principal works, more or less completely carried out by means of the ready access granted to these collections, confining himself, however, to those which have been in progress during the last six years.

"I have here to mention that this establishment has, during the last year, rendered a most important service to Indian botany, by rescuing from total destruction the enormous collections of plants made under the orders of the Indian Government, by officers of their service, and which had been accumulating for thirty years in the cellars of the India House. In consequence of the urgent remonstrances that emanated from Kew, the Honourable East India Company consented to these collections being arranged under our supervision, and to defray the necessary expenses for carriage, materials, and assistance in arranging and preserving them. In July last, the collections arrived and the work of inspection and selection commenced. The whole are still regarded as appertaining to the department of the Government of India, who will decide upon their ultimate destination."

After noticing the collection of botanical prints and drawings, the report concludes by pointing out the further service rendered by this garden to horticulture and botany, in the several missions and botanical explorations that have been carried out of late years, to the great promotion of science.

RESTORATION OF DAMAGED LETTERS.

Mr. Alfred Smee, of the Bank of England, gives the following information on this subject:—

"Many letters have been delivered by the Indian mail greatly damaged, and in some cases perfectly illegible, from the action of the sea-water, at the late injury of the *Northam*. I have successfully restored the writing of one of these letters by a process I believe to be as old as the hills, though I am assured quite unknown to our merchants and bankers.

"Having been requested to publish this process for their information, I have only to state that the recovery of writing so obliterated is extremely simple.

"The letter should be lightly once brushed over with diluted muriatic acid, the strength sold as such at all chymist's shops. As soon as the paper is thoroughly damped, it must be again brushed over with a saturated solution of yellow ferruginate of potash, when immediately the writing appears in Prussian blue. In this latter operation plenty of the liquid should be employed, and care must be taken that the brush be not used so roughly as to tear the surface of the paper.

"This result is obtained by simple chymical laws, as the iron which existed in the writing-ink is retained in the fibre of the paper, and by the action of ferruginate of potash, Prussian blue is formed, the use of the muriatic acid being simply to place the iron under circumstances favourable to the action of ferruginate of potash.

"The letter should then be washed in a basin of clean water, and dried first between the folds of blotting-paper, and subsequently by holding it before the fire, when the letter is fit for the counting-house.

"If the letter should be of much permanent value, I recommend it to be carefully sized with a solution of isinglass before being filed; but if the paper has been much rotted, the operation requires care, and should not be done until a notarial copy or photograph has been taken.

"Where the operation is to be conducted by those having some knowledge of chymistry, a little of the solution of the red ferruginate of potash may be added to the yellow, as in some cases it would render the colour more complex."

COTTON SUPPLY.

The following has appeared in the *Daily News*:—

The Cotton year of the United States—in the crop of which, through our manufacturers and others, all the world is interested—always terminates on the last day of August, and we are now in possession of its history for 1859. Between September 1, 1858, and August 31 last, the quantity of Cotton received at the different ports, equivalent to the total crop, was 3,710,000 bales, against 3,078,000 bales in the preceding year—an increase of rather more than 20 per cent., but only 6 per cent. more than the large crop of 1856—3,492,000 bales. Taking the average of the five years 1855-1859 as the crop of 1857, and the average of the five years 1840-1844 as the crop of 1842, the increase in the interval of fifteen years is 60 per cent., or 4 per cent. per annum. As this is much greater than the increase of population in the interval, it is another proof of the continued general improvement in clothing, of which cotton is one of the chief raw materials.

Taking the value of each bale at 30 dollars, we may estimate the total value of the cotton crop of the States in 1859 at £24,000,000. The bulk of it, or 3,000,000 bales (actually 2,990,000) is exported, leaving 700,000 bales for home consumption, so that the States supply other nations with cotton of the value of about £18,000,000 a-year. Of the exports, 2,015,000 bales come hither, 441,000 go to France, and 543,000 go to other ports. The States supply mankind with many other things; but cotton, like the tea of China, the wine of France, the oil of Italy, the timber of Scandinavia, may be considered as the distinguishing and chief industrial product which they contribute to the well-being of society.

For us, however, the most interesting and important part of this subject is the quantity of cotton sent hither. It is, in 1859, 2,015,000 bales, against in

1858.	1857.	1856.	1855.
Bales.	Bales.	Bales.	Bales.
1,796,000	1,422,000	1,946,000	1,543,000

It is therefore considerably in excess of each of the previous four years except 1856, when it was only slightly below the present amount. In that year the crop was unprecedently large; in the following year the manufacturers were extremely busy, and the enlarged supply was adequate to their enlarged demands. In 1857 and 1858 the crop was small, below what may be considered the average, and insufficient for the enlarged and increasing demand of the manufacturers. The price in consequence, taking Uplands cotton as the example, rose in the Liverpool market from 5⅝d. per lb. in September, 1856, to 8d. in September, 1857, to fall to 6 5-10d.

in September, 1858; at present it is 5⅞d. per lb. In the great rise of price in 1857 lies the origin of the anxiety felt by our manufacturers lest the supply of the raw material should fall below their wants. The subsequent increase in the supply should dispel these apprehensions. Formerly the average increase of the supply of cotton was estimated at 3 per cent. per annum; but the late returns show, as we have observed, a continual increase of 4 per cent. per annum. The markets, too, testify to the comparative abundance, for the price is now only a single farthing per lb. above the price of the very abundant year 1856.

The apprehensions of a want of the raw material have led to many speculations and efforts on the part of manufacturers to increase it. Cotton spinners and weavers, however, are not cotton growers. It is their duty, as it is the duty of all men, to do their own work well, and trust that other men are doing equally well their part in the great system of combined production. They know nothing of the consumers of their manufactures, and very little or nothing of those who produce the raw material. Owing to the division of labour they have generally, nay, invariably, found their own wants of all other things, as well as cotton, supplied when they brought their own commodity to market, and were enabled by selling it to buy what they wanted. They must not think, therefore, of being cotton growers as well as cotton spinners, but be content to perform their own task well and trust to others to supply them with the cotton they need. They have seen, indeed, great fluctuations in the value of cotton, the consequence of varying, though generally increasing, demand and varying seasons; the extremes through a long series of years have been between 3d. and 9d. per lb.; but the fluctuations have on the whole latterly diminished, and will diminish faster as the sources of supply become more numerous and nations become more manufacturing.

Last year, to the end of December, our total imports of cotton were 1,034,342,176 lbs., of which we derived 823,000,000 lbs. from the United States, and the remainder chiefly from the British East Indies and other countries. Of these imports, however, we re-exported 149,600,000 lbs., leaving for our supply 885,700,000 lbs. We have seen, however, that the exports from the United States to other countries than Great Britain, chiefly in Europe, were almost one-half as great as the exports hither; and adding to them the exports from our country, we shall get a tolerable measure of the cotton manufactures of the other countries of Europe. Supposing that they get no supplies direct from the East Indies, the Brazils, and Egypt, but obtain all their supplies of the cotton of those countries through England, which is not exactly, but nearly, the fact, their supply and our supply stand thus:—

	lbs.
England's supply in the year ended December, 1858	885,700,000
Foreign supply from United States, year ended August, 1859	299,300,000
Foreign supply from England, year ended December, 1858	149,600,000
Total foreign	448,900,000

According to these figures, which do not represent the precise truth, but very near it, the consumption of cotton in Europe, excluding England, is about 448,900,000 lbs., while the consumption of England is not quite twice as much. Abroad, too, the consumption is increasing very fast. Since 1844 our exports of cotton thither have increased more than threefold, viz., from 421,650 cwts. to 1,335,790 cwts, in 1858. The exports from the United States thither have also increased, but not in equal proportion. It is, however, plain from these figures that Great Britain, though still the largest consumer of cotton, is by no means the *only* consumer, and that any increase of the raw material and any reduction in its price will be equally to the advantage of all the cotton manufacturing countries of Europe and the world. It may be even concluded, as the proportion of fine to coarse fabrics produced is much greater in England than in other countries, that the increase in the supply of the raw material, and the reduction of its price, will be more to their advantage than ours. They use more cotton proportionately for their fabrics than we do for ours. These two facts, that every increase in the supply of cotton will affect the general market, and will not be exclusively to our advantage, and that it may probably be more to the advantage of the foreign manufacturer than our own, should have some influence with those who are now earnestly recommending the policy of encouraging the production of cotton in our Indian territories.

We concede readily that to India, accustomed to have her industry much regulated and directed by her Governments, such a policy may be eminently advantageous. For the sake of India, therefore, let it be prosecuted. But the English people and the English manufacturers must not expect that they will exclusively benefit by an increased supply of cotton at lower prices. The advantages will be shared by all the manufacturers and all the wearers of cottons. The manufacture and use of improved clothing will be extended, but the extension will be quite as much or more in other countries than our own. Even with regard to the industry of nations it ought to be recollected, that the production of one commodity cannot be favoured except that of some other is checked, and that the wants of communities and individuals, expressed by prices, are better regulators of production than the most sagacious policy.

The following letter has been addressed to the Editor of the *Daily News*:—

SIR,—I have perused with pleasure your leading article of to-day on the subject of cotton, and am happy to bear testimony to the general correctness of your statements. I note some inaccuracies, however, to which I beg your attention.

In the first place, you estimate the value of each bale of the last American crop at 30 dollars in that country, whereas 50 dollars would be nearer the mark. The average price paid for the last crop may be roughly stated at 11 cents., and allowing the bales to average 440 lbs. gross weight, the value of each would be nearly £10; and we have little doubt that the late crop, which will prove about 3,750,000 bales, will realise 35 millions sterling, instead of 24 millions, the amount you compute it at.

In comparing the price of this staple for the last four years you take Upland cotton for your standard, but obviously base your quotations on a very low quality, instead of taking "middling" for your guide, the standard usually employed, and always implied when not specially alluded to. Your quotations for that quality would be about ⅜d. per lb. higher than those given, and which casual readers may falsely apply to it.

Lastly, I would observe that you underestimate the proportion that the continental consumption of cotton bears to our own. Instead of being about one-half, it is upwards of two-thirds, and will this year exceed 1,500,000 bales, while that of Great Britain will be about 2,250,000 bales. This error is chiefly owing to a mistake made in reckoning the weight of the American cotton exported to the continent, and which you place at 299,300,000lbs., whereas allowing 420lbs. per bale net weight, and calling the export to the continent last season 1,000,000 bales, the aggregate weight would be 420,000,000lbs.

If you insert these remarks you may remove misapprehension, and would oblige—Yours, &c.,

MERCATOR.

Liverpool, Sept. 23.

FILE CUTTING MACHINERY.

A paper on this subject, by Mr. Thomas Greenwood, of the firm of Greenwood and Batley, Leeds, was read before the members of the Institution of Mechanical Engineers during their recent meeting at Leeds, which began on Tuesday, the 6th inst.

In the course of his paper, Mr. Greenwood alluded to the fact that whilst machinery had been introduced into most manual operations, file cutting remained stationary. Various machines had been invented in America and in this country, and large sums of money had been spent by manufacturers in Sheffield, but partly from difficulties, real and imaginary, and also from the opposition of the operative file cutters, these experiments had failed up to within a recent period. So great were the prejudices of the operative file cutters that they refused to teach the apprentices how to grind their cutting chisels until the last year of their apprenticeship, and the tariff of prices remained fixed, on the supposition that no improvement had taken place in the rolling of steel, thus entirely ignoring the progress which had been made; and forgers charged the same price for drawing the taug upon a round or square rod of steel for a parallel or equalling file that they did for forging a half round taper file of the same length. The actual process of file cutting, however, was one of the simplest description. It consisted in driving a chisel of suitable form and inclination to a small depth into the prepared surface of the blank, and steadily withdrawing it again. The difficulties to be surmounted were, to present the blank perfectly parallel to the cutting edge of the chisel; to withdraw the chisel from the incision made in the blank without damaging the edge of the newly-raised tooth; to prevent a rebound of the chisel after the blow which drove the chisel into the blank, before the next blow was struck; to give a uniform traversing motion to the blank, ensuring regularity in the teeth; to proportion the intensity of the blow to the varying width of the file, so as to give a uniform depth of cut; and to perform these operations at such a speed as to make them commercially profitable. In most of the attempts which had been made, the idea had been to construct an iron arm and hand to hold the chisel, and an iron hammer to strike the blow, but the vibration which attended this mode caused irregularity in the work and a ragged and uneven edge on the tooth. The slow speed, too, at which these machines were worked rendered them unable to compete with hand labour. In the machine invented by M. Bernot, of Paris, these difficulties were obviated. The blow was given by the pressure of a flat steel spring pressing upon the top of a vertical slide, at the lower end of which the chisel was firmly fixed. The slide was actuated by a cam, making about one thousand revolutions per minute, and the chisel consequently struck that number of blows per minute, thus obviating the vibration consequent upon the blow with an iron-mounted hammer. After explaining the machine more minutely, by means of diagrams, Mr. Greenwood remarked, with regard to the durability of the cutting chisels, that it was found that they cut five times as many files as could be cut by hand, without re-sharpening. In the files cut by this machine the teeth were raised with perfect regularity, and consequently, when the file was used, each tooth performed its proper share of work; whereas, in hand cutting, from the varying power of the muscles, especially towards the close of the day, it was impossible to produce such perfectly uniform work. Every description of round or half-round files was cut by the use of a revolving bed, and dividing apparatus for round and half-round files. The paper concluded by stating that a manufactory, employing twelve of these machines, had been established at Douai, in the north of France, and another had been established at Brussels.

A machine, which had been fitted up in the room, was put into operation by means of manual power, which, however, could not give the full velocity, but notwithstanding this the work done was of a satisfactory character, the files cut being the full sized flat hand files. A discussion ensued, and in reply to Mr. Fothergill, Mr. Cowper, and others, Mr. Greenwood said that the relative cost of cutting the files, as shown by practice at Douai, was as 4d. per dozen to 2s. 8d. for manual labour, on a certain class of work, which left a large margin after the cost of the machine and power in favour of machine work. As to the durability of the files, it was decidedly greater than that of ordinary files. The difference of production was as ten to one, and the machine would last as long as ordinary complicated machinery. There was no difficulty in cutting round and half-round files. There was also an additional advantage in the equality of the work obtained. In hand labour it was found that the files made were not so good in the afternoon as those made in the morning, the muscles becoming relaxed, and the blow therefore less regular in force. It cut the taper files all one depth, but no doubt the pitch could be altered if necessary, by making the machine a little more complicated.

On the suggestion of Mr. MAUDSLAY,

Mr. GREAVES, who had charge of the machine, briefly addressed the meeting. He said that he had been engaged in file cutting twenty-five years, and he was prepared to state that the machine would cut as good files as could be made by hand, if properly attended to. It was necessary, however, that the machine should be fixed, and not re-set every half-hour.

The PRESIDENT then thanked Mr. Greenwood for his paper, and the discussion terminated.

WATER IN LIGHTHOUSES.

The following letter has been addressed to the editor of the *Times*:—

SIR,—The Trinity-house, in its care for the health of the people engaged under it in the superintendence of lighthouses, has at different times sent to me, as its scientific adviser, certain specimens of waters, which were supposed to be injurious to the persons using them. Lighthouses are, of necessity, often placed in situations where water is obtained with difficulty, and they are frequently dependent, more or less, upon that which is gathered from rain falling upon the leaden roofs, galleries, and gutters of the towers and cottages occupied by the keepers. Now, the salt of the sea spray, which often reaches these roofs, &c., even when they are half a mile or more from the shore, causes the rain water which falls upon them to dissolve a portion of the lead, which is larger or smaller under different circumstances, and at times rises up to a quantity injurious to health, and poisonous. The water thus contaminated by lead, or rather chloride of lead, is peculiar in this, that it does not lose the poisoning substance either by boiling or by exposure to the air, for the matter remains soluble after one or both of these processes. I ascertained that if a little whiting, or pulverized chalk (carbonate of lime), were added to such water, and the whole shaken or stirred together, the lead immediately assumed the insoluble state; so that when the water was either filtered or left to settle, the clear fluid was obtained in a perfectly pure and salubrious condition. The process of purification is, therefore, exceedingly simple, for if some powdered chalk or whiting is put into the cistern in which such rain water is collected, and stirred up occasionally after rain, the water may, with the greatest facility, be obtained in a perfectly fit state for all culinary and domestic purposes.

The Trinity-house has supplied this information to all the cases needing it which have come to its knowledge, but I find that some cases occur not under its charge, that there are others not connected with lighthouses, and others again in other countries, in all of which this piece of simple practical knowledge may be

useful. Under these circumstances I have thought that you, Sir, would not refuse the service of that special and extensive power of publication and instruction which the *Times* possesses, but use it to carry this knowledge to the many dispersed persons who may greatly need and yet have no other means of obtaining it.

I am, Sir, your obliged and faithful servant,

M. FARADAY.

Royal Institution, Sept. 22.

COILING SUBMARINE TELEGRAPH CABLES.

A method of coiling submarine telegraph cables, whereby the danger of kinking is stated to be avoided, has been proposed by Captain L. G. Heath, R.N., C.B. In describing his plan the author says:—

"In all spirally twisted rope there is a certain state as to the amount of twist which may be called the normal state—a state in which there is no tendency in the rope when freed from all external agency to revolve either one way or the other—but if by any means an additional twist should be put into the rope, whilst in this normal state, it will have a tendency to untwist itself, whilst on the other hand if a twist is taken out, it will have a tendency to twist itself up again. It is in this normal state that the cable is delivered by the manufacturer, being generally wound on a drum, and if it could be payed out direct from that drum by its revolution round its axis, it would be submerged in its normal state, and no danger of kinking would arise. This was the plan adopted in laying the Black Sea Telegraph Cable during the Russian war, and it should be and probably is adopted for all short lines, but the impossibility of coiling such a mass as the Atlantic cable on one drum, or of controlling its speed if it were so coiled, and the difficulty of connecting the ends if the cable were divided into parts and coiled on several smaller drums to be used in succession, seem to render this plan impracticable for long cables; they are therefore transferred from the manufacturer's drum to the hold of the laying out ship, where they are most carefully coiled on flat platforms. It is this coiling which produces a tendency to the formation of kinks, because for every circle made in the process an extra twist (beyond the normal number) is put into the rope, which extra twist remains in the rope when it is payed out, as may be shown to those new to the subject, by the following simple experiment.

"Take 20 or 30 fathoms of rope in its normal condition as to twist, and place it straight along the ground so that it shall represent the rope when just completed in the manufacturer's rope walk, paint a line along the whole length of its upper surface, and then, making one end fast to a low peg in the ground, imitate the process of coiling it into a ship's hold, count the number of circles formed, and laying hold of the last coiled end walk away with it (as if the cable were being submerged) until the rope is again stretched out, and you will see the painted line spirally wound round with a number of circles made in the first part of the experiment. Now this is, on a small scale, exactly what happens when a larger cable is coiled in and laid out from a ship in the usual manner; a number of twists in excess of what I have called the normal number are put into the cable, and in that state is the cable laid out. If in your experiment you have used a cable of the ordinary stiffness and rigidity, you will have seen plainly how these extra twists tend to form the much dreaded kinks. In shoal water on a regular bottom the danger is but small, because the friction of the rope on the ground will prevent the twists working up towards one another, but in deep water with rough bottom, the cable will, as has frequently been suggested, perhaps hang suspended between distant points, and it is then more than probable that these twists will work up by a sort of worm-like motion towards one another, and form knots of kinks such as were described as having been found in the Atlantic Telegraph Cable.

"Newall's cones and rings are valuable contrivances for preventing the formation of kinks whilst the cable is leaving the ship, but they do not destroy the materials of which kinks are formed. Those materials, under the common system of coiling, leave the ship with the cable and are evermore present with it, ready to develop themselves as kinks whenever favourable circumstances arise.

"The remedy which I propose is to coil the successive sheaves alternately right and left-handed, so that the right-handed twists formed in one sheave will be exactly neutralized by the left-handed twists in the next, and the cable will thus be submerged in its normal state."

STEAM TOWAGE OF BOATS ON CANALS.

Many attempts have at various times been made* to employ upon canals steam tugs, propelled by paddles or screws, in place of traction by horses. The objection raised against them, however, is always the same—that the waves created by the propelling surfaces injure the banks, gradually washing them down into the canal, and thus decreasing its depth. An ingenious but very simple contrivance is now being applied for achieving the object without either paddle or screw, or, in fact, any other means of propulsion, strictly so called. The mode employed is practically one of traction, by chains, acting on the bottom of the canal or river, instead of upon the towing path at the side. The plan is the invention of Mr. William Robertson, engineer, of Strangeways, Manchester, who has patented it, and the principle is being carried out by "The Chain Propeller Company." The new method has been tested by experiments, with the sanction of Mr. Fereday Smith, on the Bridgewater Canal, between Patricroft and Leigh. An ordinary canal flyboat has been adapted to the purpose. It is 70 feet long, and 7 feet beam, but a new one, of more suitable model, is in course of construction. An engine, of about 8-horse power, is placed on the fore part of the boat, which drives a shaft having a grooved wheel, 2 feet 4 inches in diameter, projecting slightly from each side of the bow. There is a similar pair of wheels, or rather pulleys, near the stern, one on each side. An endless chain is then placed (on each side of the boat) upon the fore driving wheel and stern pulley, with sufficient slack in it to admit of its reaching to, and lying upon, the bottom of the canal. At the first experiment, the chain used was 20lb weight to the yard, and it was one of the lightest employed. The driving wheels and stern pulleys are 57 feet apart, but there is a series of smaller running pulleys over which the chain passes after it has come out of the water at the stern, on its way to the wheels at the bow. The weight of the chain used is in proportion to the weight to be drawn, and to the power of the engine. For towing purposes, four chains—two on each side—are employed. The chain may be regarded as constituting an anchor, lying along the bottom, which the engine is continually heaving in at the stern, and as continually depositing a fresh supply at the head. By this action, it will be seen that a fulcrum is obtained without the water being scraped away from the sides, as by paddles, or forced away from the stern and bottom, as by the screw. At the trial trip there were on board Mr. Bryson, the resident engineer of the Bridgewater Trust; Mr. Marsden, Mr. Grundy, and Mr. Kent; Mr. Robertson, the inventor, and several other gentlemen. The distance from Worsley Bridge to Leigh is six miles, and it was run, with the single light chain, in an hour and a half, being four miles per hour. There was found, however, to be too much ballast in the stern of the boat, the progress of which was retarded by the hind pulleys dipping into the water. This was remedied in returning, and the speed was nearly five miles per hour. A careful observation showed that the chain had travelled eight

* A similar invention was tried some years since by a Captain Brown, but without success.—Ed. *J. S. A.*

miles while the boat had travelled six; or that the slip of the chain along the bottom of the canal was nine inches in each yard. The general impression seemed to be that with two chains (or one of double weight), which would double the amount of grip upon the bottom of the canal, this slip would almost entirely disappear. By this mode of progression the water is in no way disturbed, as there is, of course, nothing in the dropping of a chain into the water and hauling it out again which can ruffle the surface. The conditions are precisely the same as those of a vessel drawn at the same speed by horses, except that the descent of the chain from each bow, rather tends to break the wave caused by the head of the boat. The experiments were devoted subsequently to the towage of laden coal boats, when two chains were employed. The plan has been tested, and the result proved highly satisfactory. The slip, by the use of two chains, was entirely removed. The speed attained was double that by horses with an equal load.

SILKWORM OF THE AYLANTHUS.

Some further researches in reference to this silkworm, which is stated to be the true *Bombyx Cynthia* (see *Journal*, Vol. VI., p. 630) have been lately laid before the French Academy of Sciences, by M. F. S. Guérin-Méneville. These investigations were undertaken by order of the Emperor, in the department of Var, in the south of France, and were carried out on a considerable scale.

Some of the silkworms were placed in a closed room, others in a greenhouse constantly open both day and night, and others in the open air on frames left constantly exposed, and fixed upon moderately high trees, covered with nets to keep off the birds. It is remarkable that the silkworms kept in the open air were exposed to several violent storms of wind and rain, without suffering any injury.

The conclusions which M. Guérin-Méneville draws from his experiments are that these silkworms may be considered as acclimatised in France, and can be kept on trees in the open air, almost as easily as in China; that cocoons produced in this manner are larger and richer than those which result from worms kept either in close or open rooms. He is of opinion that their management presents little difficulty, and would be found very inexpensive when once the breeding of the worms became regularly organised.

The tree on which the worm feeds is stated to grow in the worst kinds of soil, where little else will flourish, and with regard to the textile material which it is believed will thus be produced at a low price, M. Guérin-Méneville thinks it will become in France, what it has long been in China, the silk of the people.*

Proceedings of Institutions.

SYDNEY MECHANICS' SCHOOL OF ARTS.—The Report for last year states that various unavoidable circumstances have combined to limit the Institution's sphere of operations and usefulness. Amongst these may be mentioned the continued depression of trade; the removal from Sydney of many members, owing to the excitement attending the Fitzroy diggings; the multiplication of institutions similar in many of their objects to the Sydney School of Arts; the long continued illness of the Secretary, originally brought on by the very defective sanitary condition of his apartment on the premises of the Institution; and lastly, the want of suitable accommodation for the members generally in the present inconvenient and unsightly building. Most of these causes of depression, however, the committee regard as temporary in their character, and they look forward with confidence to a brighter and more successful future. The reading-room continues to be very well attended, and is, beyond question, the most complete and satisfactory department of the Institution. During the past year the sum of £223 17s. 4d. has been devoted to it, of which £146 17s. 7d. were remitted to England, and £76 19s. 9d. disbursed in the colony. In the library department some signs of progress may be discerned. The number of volumes added since the last report is nearly 600, of which about 450 are entirely new works. Some of the additions made, and others which are ordered, are works of a permanently useful character. Without wishing to discourage reading of a lighter and more amusing sort, the committee have felt that the shelves of this Institution ought to contain a greater proportion of works calculated to elevate the literary tastes and inform the minds of the members. The library of a Mechanics' School of Arts should, in their opinion, be something very much better than a mere cheap circulating library. It should contain such standard books on the various branches of science and art, social and political economy, &c., as will enable the students in the various classes, the members of the discussion class, and the attendants at the lectures, to carry out their studies to definite and satisfactory conclusions. The whole number of volumes now in the library is 7,200, and the issues during the year have been about 25,000. The sum of £219 3s. 9d. has been expended in the library during the year. The following is a list of the lectures delivered during the past year, and an inspection of it will show how much the Institution is indebted to its friends for their gratuitous as well as able and efficient services:—Inaugural Address, by His Excellency Sir W. T. Denison, K.C.B.; "Currer Bell and her Writings," by J. L. Michael, Esq.; "Why we breathe and how," by S. Boyd, Esq., M.D.; "Egypt in the Olden Time," by the Rev. G. H. Stanley, B.A.; "On Law," by J. F. Hargrave, Esq.; "New Truths and their Reception," by C. Meymott, Esq., M.R.C.S.; "Why we breathe and how," (second lecture) by S. Boyd, Esq., M.D.; "A Sojourn in France," by C. Kemp, Esq.; "Natural and Artificial means of Locomotion," by J. Dyer Esq.; "A Sojourn in Mexico in 1832 and 1833," by S. A. Donaldson, Esq., M.L.A.; "Pompeii, or Life in Ancient Italy," by A. Gordon, Esq.; "Air, and some of its Properties," by A. Cane Esq.; "Meteorology," by the Rev. W. Scott, Colonial Astronomer; "On Drawing," by J. Fowles, Esq; "Elementary Mechanics," by Rev. D. Boyd; "Carbonic Acid," by Professor Smith; "On the study of English Law," by J. F. Hargrave, Esq.; "Greek ideas of Pleasure and Love," by Professor Woolley, D.C.L. Classes in the following subjects have been carried on during the year:—French, Drawing, Mathematics, English Grammar and Composition, and Elocution, Vocal Music, Latin. In connection with the subject of Class Examination the Committee call attention to the practice, now so general in the home countries, of requiring certificates of qualification from all candidates for appointments to the civil and military services. The important results produced by this, on educational institutions, are already observable; and the Committee are of opinion that an application of such a system to this Colony, in connection with the Schools of Art and other educational institutes, would furnish a healthy stimulus to the young men of Australia. The erection of a suitable and convenient building for this Institution has long been an object of most earnest desire on the part of its Committee. The requirements of the ordinary operations have considerably outgrown the accommodation afforded by the premises, and further usefulness is for the present checked. Accordingly the Committee have determined

* See also a paper on the silkworm of the *Ricinus*, in the recent Vol. of the *Journal*, page 670.

to enlarge the present building, the cost of effecting the new works being estimated at about £3,000. The number of entirely new members who have joined the Institution since last Report is 309. The total number of existing members is 846. The treasurer's account shows that the income of the year was £1149 2s. 5d.

PATENT LAW AMENDMENT ACT.

APPLICATION FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, September 23rd*, 1859.]

Dated 6th August, 1859.

1814. C. C. R. Goudenove and A. Feret, 60, Rue Neuve St. Augustin, Paris—An imp. in gas burners. (Partly a com.)

Dated 16th August, 1859.

1856. W. Leatham, Leeds—An improved double acting superlative screw throttle valve.

Dated 22nd August, 1859.

1910. J. Gregory, Barreiro, Portugal—Imp. in locomotive and other steam engines.

Dated 30th August, 1859.

1970. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the construction of steam generators, applicable also to the construction of condensers, the heating of water generally, and to the warming of buildings. (A com.)
1972. G. Collier, 23, Elizabeth-street, Eaton-square—Imp. in chairs and couches.
1974. J. Field, Lambeth—Imp. in apparatus for superheating steam.
1976. H. Hutton, Palace-road, Lambeth—An improved lubricator.

Dated 31st August, 1859.

1978. J. Cowgill and J. Stocks, Bradford—Imp. in caps for spinning fibrous substances, and in the means or method of manufacturing the same.
1980. W. A. Von Kanig, Hardinge-street, Islington—Imp. in the manufacture of starch and compounds of starch, and in extracting gum dextrine and grape sugar therefrom.
1984. J. Mackenzie and T. Wentworth, St. Martin's-le-Grand—Imp. in breech-loading fire arms.
1986. J. Samuel, Great George-street, Westminster—Imp. in railway sleepers.
1987. H. Higgin, Bow, Middlesex—Imp. in machinery for cutting and preparing match splints.
1988. L. Berge, Newgate street—An improved method of fastening or securing portemonnaies, bags, and other like articles with frames.
1990. E. Ellis, St. Ann's Well-road, Nottingham—Imp. in finishing silk fabrics made on bobbin net, and warp frames.

Dated 1st September, 1859.

1992. J. Brine, Maidstone, Kent—Imp. in the mode of preparing, arranging, and combining the leaves of books to be used for producing simultaneously one or more fac-simile copies of letters, accounts, or other such similar documents or writings.
1996. J. Borrington, Derby—Imp. in pumps.

Dated 2nd September, 1859.

1998. P. Wright, Dudley, Worcestershire—An imp. or imps. in the manufacture of anvils.
2002. J. K. Watson, Edinburgh—Imp. in gas meters and exhausters, washers, and purifiers.
2004. W. Clough, Wigan, Lancashire—Certain imp. in machinery or apparatus for propelling vessels on water.
2006. W. A. Turner, Manchester, and H. L. Lilley, Stand-lane, Manchester—Imp. in the manufacture of starch.
2008. J. F. F. Leroux, 29, Boulevart St. Martin, Paris—A new or improved apparatus to be employed for taking money on the counters.
2009. T. Hedgcock, Ivy-cottage, Great Church-lane, Hammersmith—An imp. in quadrants.
2010. J. Spurgin, Great Cumberland-street, Middlesex—Imp. in ordnance and projectiles.

Dated 3rd September, 1859.

2018. G. Parsons, Martock, Somersetshire—Imp. in wheels.
2020. H. Swan, 5, Bishopsgate street Without—Imp. in stereoscopes and stereoscopic pictures.

Dated 5th September, 1859.

2022. F. C. Bakewell, 6, Haverstock-terrace, Hampstead—Imp. in the manufacture of caustic alkalies. (A com.)
2026. W. L. Earle, Alfred-place, Bedford-square—Imp. in apparatus for promoting the combustion of smoke and gases arising from fuel.
2028. A. V. Newton, 66, Chancery-lane—Imp. in sewing machines. (A com.)

Dated 6th September, 1859.

2030. G. Lowry, Salford, Lancashire—Imp. in machinery for heckling flax and other fibrous materials.
2034. A. V. Newton, 66, Chancery-lane—An improved fabric, applicable to the manufacture of hose or flexible pipes. (A com.)
2036. E. Blake, 61, Tachbrook-street, Pimlico—Imp. in apparatus for and in treating China-grass rhea, fibre mudar, and other similar vegetable fibres.

Dated 8th September, 1859.

2049. T. Hoodman, 490, Oxford-street—An improved stock, cravat, or neck muffler or wrapper.
2051. J. Nicholson, Chaple House, Hensingham, Whitehaven, Cumberland—Imp. in horse rakes.
2053. J. Thorley, Newgate-street—An improved preparation of food for cattle and horses.
2055. T. W. Allsopp, Castle Donington, Leicestershire—Imp. in portable gas apparatus.

Dated 9th September, 1859.

2057. W. Roscoe, Croxteth Hall, West Derby, Lancashire—An improved agricultural implement or machine for distributing guano and other manures upon land.
2059. J. G. N. Alleyne, Butterley Iron Works, Alfreton, Derbyshire—Imp. in the manufacture of wrought-iron beams.
2061. F. Carpenter, Porter-street, Westminster—An improved apparatus for cutting tobacco.
2063. S. Cornely, Lime-street—An imp. in the permanent way of railways. (A com.)

Dated 10th September, 1859.

2065. H. O. Robinson, Westminster—Imp. in machinery or apparatus for the manufacture of sugar.
2067. J. Pollock, Leeds—Imp. in the manufacture of beds, couches, and invalid or other carriages.

Dated 12th September, 1859.

2071. T. G. Gutch, Southampton—The imp. of copying books, for order books and letter books, and so forth, as the imp. can be applied.
2075. F. Heindryckx, Brussels—Imp. applicable to railways or tramways.
2077. F. Versmann and A. Oppenheim, Bury-court, St. Mary Axe—Imp. in the treatment of various substances, so as to render the same non-inflammable.
2079. F. N. Gisborne and L. S. Magnus, 3, Adelaide-place—Imp. in telegraph cables.
2081. H. G. Collins, McLean's-buildings, New-street-square—Imp. in producing printing surfaces on stone, metal, and other materials capable of being employed in printing, in the manner of lithographic stones, also in the production of printing plates and surface printing blocks, and in transfer inks.

Dated 13th September, 1859.

2085. G. M. Levi, Val Benoit, Liege, Belgium—Imp. in washing and separating ores and substances of different specific gravities, and in apparatus for that purpose.
2087. J. Grainger, Birmingham—Imp. in breech-loading firearms, and in moulds for making projectiles.
2089. W. E. Newton, 66, Chancery-lane—Improved apparatus for drying paper and other fabrics. (A com.)

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, September 23rd*, 1859.]

September 22nd.

719. J. Davis.
724. J. T. Pitman.
725. E. Maynard.
726. S. Newington.
728. W. P. Wilkins.
731. R. A. Brooman.
732. J. Tyssen.
733. C. A. Watkins.
735. S. Oram.
738. W. Middleship.
740. B. Browne.
742. G. Neal.
746. F. Tillett.
747. W. Garforth & J. Garforth.
748. W. E. Wiley.
750. F. E. Sharp.
752. C. Sanderson.
756. R. Baker.
762. W. Redgrave.
763. E. Steane.
765. M. Frith.
766. G. Naylor.
767. J. C. Evans and P. Soames.
771. J. Buckley, O. Greenhalgh, and R. Hutchinson.
773. C. F. Vesserot.
774. J. Buckingham.
779. C. L. Roberts.
781. J. W. Kelly.
785. R. Searle.
786. Isaac Spight.
787. T. Taylor.
788. H. P. Burt.
789. H. Moss and T. West.
889. J. H. Young.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, September 23rd*, 1859.]

September 19th.

2235. J. Cottrill.

September 20th.

2315. P. A. Le Comte de Fontaine-Moreau.

September 21st.

2239. W. Beatson.
2251. J. J. Russell and J. B. Howell.

[*From Gazette, September 27th*, 1859.]

September 24th.

2265. D. Law and J. Inglis.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

September 23rd.

264. A. V. Newton.

September 24th.

11. T. W. Gray.
12. T. W. Gray.
70. R. Lakin and W. H. Rhodes.